A SURVEY OF BENTHIC MACROINVERTEBRATES NEAR THE MOUTH OF THE GRAND RIVER, LAKE ERIE, 1981

January 1983

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Environment

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TECHNICAL REPORT DATA

1. TITLE

A Survey of Benthic Macroinvertebrates Near the Mouth of the Grand River, Lake Erie, 1981

2. REPORT DATE	**3. CONTRACT NO.**
January 1983	A 71587

4. AUTHOR(S)	**5. PROJECT OFFICER**
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6. PERFORMING ORGANIZATION	**7. SPONSORING AGENCY**
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8. ABSTRACT

Benthic macroinvertebrates were collected from 15 stations near the mouth of the Grand River in Lake Erie during late August and early September 1981. A total of 28 Ponar grab samples were taken at 11 stations by MOE personnel, 18 airlift samples were collected by divers at 6 stations. The substrate at most stations was heavily silted. Boulders occurred nearshore to the east, clay offshore in the west. The samples contained a total of 89 taxa which included 20 Oligochaeta, 16 Chironomidae, 13 Sphaeriidae and 11 Gastropoda. Total invertebrate standing stocks varied significantly among stations; the largest counts occurred near the mouth of the river, the smallest at the stations furthest offshore. This pattern must be viewed with caution since the airlift caught 7-times as many animals as the Ponar at the one station sampled with both devices. Eight communities of invertebrates were recognized in the study area. Limnodrilus spp. (especially L. cervix and L. hoffmeisteri) were dominant at 5 stations. Aulodrilus spp. dominated 3 stations. A Limnodrilus-Chironomus assemblage characterized 2 stations, and each of the other 5 stations were somewhat unique. No clear relationships were detected between community-type and depth or type of substrate but the Limnodrilus community seemed to correspond to areas of maximum deposition of silt from the river. Substrate instability due to periodic deposition and resuspension appears to be the major impact of the Grand River in the study area. The present survey also suggests at least some organic enrichment associated with zones of deposition.

As indicated by the type of species and density of benthic macroinvertebrates, the Grand River mouth area is subject to a heavy load of suspended solids, either organic or inorganic and is highly eutrophic.

9. DESCRIPTORS	**10. IDENTIFIERS**
benthic macroinvertebrates, nearshore zone, sediment distribution, species variation	eastern basin Lake Erie, Grand River mouth

11. DISTRIBUTION STATEMENT West-Central Region (MOE), Government of Canada, Grand R. Conservation Authority, International Joint Commission, Centre Lake Erie Area Research (CLEAR) Ohio State U., Consultants, Libraries, Citizen Groups, Public

FOREWORD

The study of benthic macroinvertebrates in the Grand River mouth area was aimed at providing baseline data to assess industrial and municipal development and pollutant control programs upstream in the Grand River watershed and an insight into the impact of the Grand River on Lake Erie nearshore.

This study was carried out under contract with Barton Biological Consulting and is being submitted as part of this Ministry's contribution to the Great Lakes International Surveillance Plan (GLISP) for Lake Erie.

Results presented in this report are based on two different sampling techniques, Ponar grab samples and airlift sampling using divers. The airlift sampling technique was necessary at locations where the bottom substrate consisted of rock and boulders. This technique has previously been employed in other locations such as Lake Huron, Georgian Bay and the North Channel and was found to best reflect the actual population of benthic invertebrates. In this study, populations of benthos recovered by airlift were found to be seven times greater than those found by Ponar. It is likely that in future studies related to benthos, the airlift technique will replace all Ponar type sampling.

This project was undertaken as part of the Canada-Ontario Agreement on Great Lakes Water Quality and as such received federally assisted funding.

DISCLAIMER

This report has been reviewed by the Great Lakes Section, Water Resources Branch, Ontario Ministry of the Environment and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Ontario Ministry of the Environment.

A SURVEY OF BENTHIC MACROINVERTEBRATES NEAR THE MOUTH OF THE GRAND RIVER, LAKE ERIE, 1981.

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Contract P.O. No. A 71587

January 1983

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Summary

Benthic macroinvertebrates were collected from 15 stations near the mouth of the Grand River in Lake Erie during late August and early September 1981. A total of 28 Ponar grab samples were taken at 11 stations by MOE personnel, 18 airlift samples were collected by divers at 6 stations. The substrate at most stations was heavily silted. Boulders occurred near shore to the east, clay offshore in the west. The samples contained a total of 89 taxa which included 20 Oligochaeta, 16 Chironomidae, 13 Sphaeriidae and 11 Gastropoda. Total invertebrate standing stocks varied significantly among stations; the largest counts occurred near the mouth of the river, the smallest at the stations furthest offshore. This pattern must be viewed with caution since the airlift caught 7-times as many animals as the Ponar at the one station sampled with both devices. Eight communities of invertebrates were recognized in the study area. *Limnodrilus* spp. (especially *L. cervix* and *L. hoffmeisteri*) were dominant at 5 stations. *Aulodrilus* spp. dominated 3 stations. A *Limnodrilus*-*Chironomus* assemblage characterized 2 stations, and each of the other 5 stations were somewhat unique. No clear relationships were detected between community-type and depth or type of substrate but the *Limnodrilus* community seemed to correspond to areas of maximum deposition of silt from the river. Substrate instability due to periodic deposition and resuspension appears to be the major impact of the Grand River in the study area. The present survey also suggests at least some organic enrichment associated with zones of deposition.

INTRODUCTION

The Grand River is the largest tributary entering the eastern basin of Lake Erie. Its drainage basin is mainly used for agriculture but also supports a large human population, especially in the cities of Dunnville, Brantford, Cambridge, Kitchener, Waterloo and Guelph.

This report describes the results of a survey of benthic macroinvertebrates in the nearshore zone of Lake Erie in the vicinity of the mouth of the Grand River. Previous surveys have included stations in the area (Veal and Osmond 1968, St. Jacques and Rukavina 1973,Flint and Merckel 1978) but have not considered the impact of the river on the lake.

METHODS

Figure 1 shows the location of stations sampled during this survey. Three samples were collected from each of 8 stations, 2 from one station and single samples from 2 others, during 19-21 August 1981, by MOE personnel using a Ponar grab. Sediments were described from visual inspection of the grab samples. Animals were concentrated by washing the samples through a 500µm seive and fixed with 10% formalin. Invertebrates were sorted from the samples by MOE personnel. (Two samples were received by the author which were labeled 'Station 1082'. There was no mention of this station in the accompanying field notes, so the samples have been assigned to Station 1071 on the basis of their contents.)

Six stations were sampled by divers on 6 September (fig. 1). An airlift (Barton and Hynes 1978) equipped with a 500 µm mesh

collecting bag was used to collect animals enclosed by a 400 cm^{-2} quadrat placed on the bottom. Three samples were collected from each station. Each sample was preserved immediately in 10% formalin. Sediment type was noted by the divers. Dangerous diving conditions (no visibility, strong currents) precluded sampling at stations deeper than 8m.

Animals were sorted from the airlift samples with the aid of a dissecting microscope and all invertebrates from all samples were identified and counted at the lowest practical taxonomic level (see Appendix). In samples in which they were very numerous, a subsample of at least 100 oligochaetes was identified. All specimens were examined in all other samples.

Mean estimates of total abundance of invertebrates at stations from which 3 samples were collected were compared using one-way analysis of variance after log transformation of sample counts (Elliott 1977) and significant differences among the means were determined using Duncan's multiple range test (Edwards 1972). Invertebrate communities were distinguished by examining a matrix of coefficients of similarity [$PSC = \sum \min(a,b)$, where a and b are the percentage contribution of each common taxon at the two stations being compared] (Johnson and Brinkhurst 1971) calculated for each pair of stations after pooling the replicate samples from each station.

RESULTS

Sediments near the mouth of the Grand River included large amounts of silt at most stations (fig. 2). Sands occurred near the river mouth (Stations 1281 and 1054), gravel to the east and offshore in the centre of the bay (1284, 1285, 1283), boulders at nearshore eastern stations (1288, 1133) and clay offshore (1236, 1139). Coarse organic detritus (sticks, leaves, etc.) was abundant at Stations 15-016, 1281, 1054, 1284 and 1285.

89 taxa were recognized from the 46 samples examined, and these are listed with the complete results in the Appendix. The most diverse group was the Oligochaeta (20 spp.) followed by Chironomidae, Sphaeriidae and Gastropoda. The most common taxa were *Limnodrilus cervix*, *L. hoffmeisteri*, *Aulodrilus* spp., *Procladius*, *Chironomus* spp. and *Tanytarsus*.

Mean total standing stocks of invertebrates ranged from 1458 m^{-2} at Station 1236 to 27,793 m^{-2} at Station 1054. Analysis of variance among stations at which 3 samples were collected (i.e. Stations 15-016 and 1071 were omitted) indicated that there were highly significant ($p \leq 0.001$) differences among the estimates of abundance:

	SS	df	MS	F
Stations	5.135	12	0.428	6.028
Error	1.845	26	0.071	
Total	6.980	38		

Duncan's multiple range test, with $p=0.05$, indicated that Stations 1281 and 1054 supported significantly more animals than all other stations, but were not different from each other. Differences among the abundance estimates at Stations 1139, 1284,

1133, 1282, 1288, 1279, 1064, 1283 and 1285 were not significant, nor were those among Stations 1236, 1280, 1139, 1284, 1133, 1282, 1288 and 1279. The distribution of these zones of abundance are shown in Figure 3. Stations 15-016 and 1071 could not be used in the calculations but were coded on the basis of the 1 or 2 samples collected at each.

The significance of the lower standing stocks at the 11 stations sampled with the Ponar may not be real but rather a reflection of the relative inefficiency of the Ponar. The table below compares the total counts of invertebrates in Ponar samples with those in airlift samples from Station 1285 (t-value was calculated after log-transformation):

	Ponar	Airlift
	66	247
	37	393
	24	233
$\bar{X}$	38.8	282.8

$t = 5.900$ df=4 $p \leq 0.01$

The difference, 7 times as many animals in the airlift samples, is highly significant. Qualitatively, the two sets of samples were similar except for the large numbers of <u>Manayunkia</u> <u>speciosa</u> found in the airlift samples (Appendix). The airlift samples from Station 1054 contained 30 times as many animals as the single Ponar sample obtained at that station.

PSC, an index of similarity, reflects both the qualitative composition of the samples and the relative abundance of individual taxa. Inspection of the PSC matrix (Table 1) shows that the most dissimilar stations were 1236 and 1282. The former supported a diverse, low density community dominated by Nematoda,

Sphaeriidae and Asellus racovitzai, and the latter a high density community dominated by species of Limnodrilus. On the basis of further examination of Table 1 and the actual composition of the samples, a further 6 communities were recognized and these are plotted in Figure 4. The Limnodrilus community ('D' in Fig. 4) occurred at 5 stations in the centre of the study area. The Aulodrilus community ('C') and Limnodrilus-Chironomus community ('E') were found at 3 and 2 stations, respectively, while each of the other 5 stations was more unique. There were no clear relationships between community-type and depth or type of sediment.

DISCUSSION

Previously published studies of the benthic fauna of near-shore Lake Erie in the vicinity of the Grand River have described communities of invertebrates similar to some of those found in this survey. Tubificids, chironomids and amphipods were the dominant groups in samples from 9 stations studied by Veal and Osmond (1968). Their mean estimate of 3900 animals m^{-2} for the entire eastern portion of the eastern basin was somewhat lower than that reported here. Flint and Merckel (1978) sampled one station at a depth of 20m near the present Station 1236 but gave no estimate of abundance beyond mentioning that annual minimum numbers of animals were recorded in September and October throughout the eastern basin. Stations located west of the Grand River supported about 10,00 animals m^{-2}. Dominant organisms near the north shore included Bithinia tentaculata, Sphaerium corneum, Potamothrix vejdovskyi, Peloscolex ferox, Aulodrilus

pluriseta, *Pisidium* sp., Amphipoda, *Asellus* sp. and Nematoda. Species of *Limnodrilus*, which dominated many stations in the present survey, were listed as major components of the fauna only at stations further offshore.

Such surveys, as well as those by Brinkhurst et al. (1968), were intended to give an overall picture of benthic communities from fairly large areas of the lake, and thus most small-scale variation was ignored. The present survey emphasizes such variation.

Nearshore areas of large lakes are complex and often very heterogeneous, reflecting the underlying geology, the energy regime imposed by wind-generated waves and the effects of allochthonous inputs of sediment and organic matter. Each of these factors is important in the present study area. The underlying Devonian limestone and dolomite bedrock is exposed near shore, especially near Rockhouse Point. The scouring action of waves generated by the prevailing southwesterly winds keeps the eastern portion of the study area clear of fine sediments (sands, silts and clays) introduced by the Grand River, apparently even well offshore as evidenced by the failure of the Ponar grab at Station 1075. Sediments and organic detritus carried by the river are deposited directly off the river's mouth and somewhat to the west. Sands settle near shore; silts and clays further out. Observations made while diving were that the silt is not very cohesive, which suggests that resuspension is fairly common.

Since Barton (1980) found that most of the common nearshore species in Long Point Bay exhibited significant preferences for sediments of certain textures, it might be expected that the

fauna would reflect the distribution of sediments near the mouth of the Grand River. To some extent this was the case, but no significant trends were apparent at the species level. Silty clay and silty gravel each appeared to support 2 or 3 different communities, while the Aulodrilus community occurred both on silt and silty sand. Several factors are probably responsible for the apparent lack of substrate specificity in the present survey including the relatively small number of samples, the crude characterization of sediment texture and, most importantly, the influence of the Grand River.

For most species in Long Point Bay, substrate preferences were statistical trends, not absolute requirements, and these were based on correlation with precisely analyzed sediments. The influence of rivers on the benthic fauna of lakes is much more dramatic, typically resulting in an increase in the number of tubificids (especially Limnodrilus spp.) whether the river carries a heavy burden of organic pollution (e.g. Detroit R. - Carr and Hiltunen 1965, Veal and Osmond 1968; Niagara R. - Hiltunen 1969) or is relatively clean (e.g. Nottawasaga R. - Barton and Carter 1979). In either case it seems that the settling out of suspended solids, either organic or inorganic, near the rivermouth favours certain Tubificidae. The similar responses of benthic communities to deposition of dredge spoils (Flint 1979, Sweeney et al. 1975) suggest that disturbance of the habitat may be nearly as important an environmental stress as heavy organic pollution.

The benthic communities found near the mouth of the Grand River indicate that the river's major impact is due to the heavy load of suspended solids which settle in the nearshore zone. An additional assessment of organic contamination is suggested by the relative abundance of *L. cervix* and *L. hoffmeisteri* and the tolerant chironomids *Procladius* and *Chironomus* spp., but contradicted by the relative absence of *Tubifex tubifex* and the abundance of *Aulodrilus* species. The low numbers of *Gammarus fasciatus* and *Asellus racovitzai* are very unusual for the nearshore zone of Lake Erie, but the former may be at a normal seasonal low (Clemons 1950) and the latter is well-known to be adversely affected by substrate instability (Kerr 1978).

This evaluation is based largely on the qualitative results of the survey. Quantitative estimates of trophic status, such as that based on the abundance of Tubificidae, and especially *Limnodrilus* spp.(Carr and Hiltunen 1965), suggest that Stations 1054 and 1281 be considered grossly polluted and the remaining stations lightly to moderately polluted. In view of the apparent differences in the efficiencies of the Ponar and the airlift, such an assessment must be treated with considerable caution.

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TABLE 1. Similarity values (PSC) between pairs of stations near the mouth of the Grand River.

STATION	15-016	1054	1064	1071	1133	1139	1236	1279	1280	1281	1282	1283	1284	1285	1288
15-016	-	26	34	30	20	38	11	41	22	25	32	28	21	26	12
1054		-	60	60	49	37	3	49	24	56	62	59	22	48	9
1064			-	69	51	44	2	60	25	62	69	67	23	51	6
1071				-	52	46	3	74	24	61	88	86	23	53	8
1133					-	45	13	51	33	61	49	49	37	64	19
1139						-	30	66	25	40	46	48	22	45	14
1236							-	13	6	5	2	2	5	14	12
1279								-	27	56	69	74	23	58	10
1280									-	43	22	21	48	30	14
1281										-	58	60	49	61	21
1282											-	88	20	48	6
1283												-	22	43	6
1284													-	48	24
1284														-	47

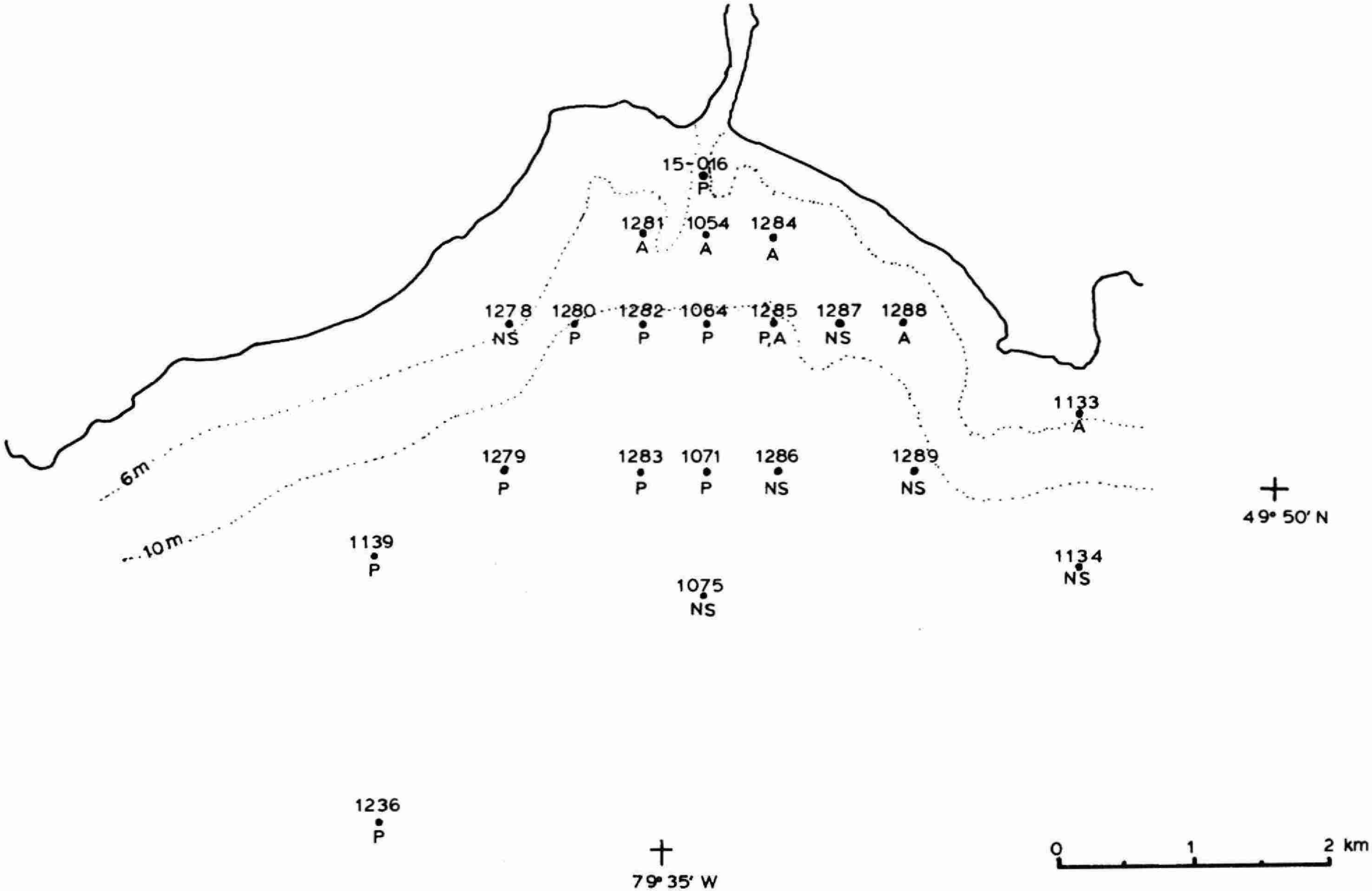

Figure 1. Location of sampling stations near the mouth of the Grand River.
P = Ponar grab, A = airlift, NS = not sampled.

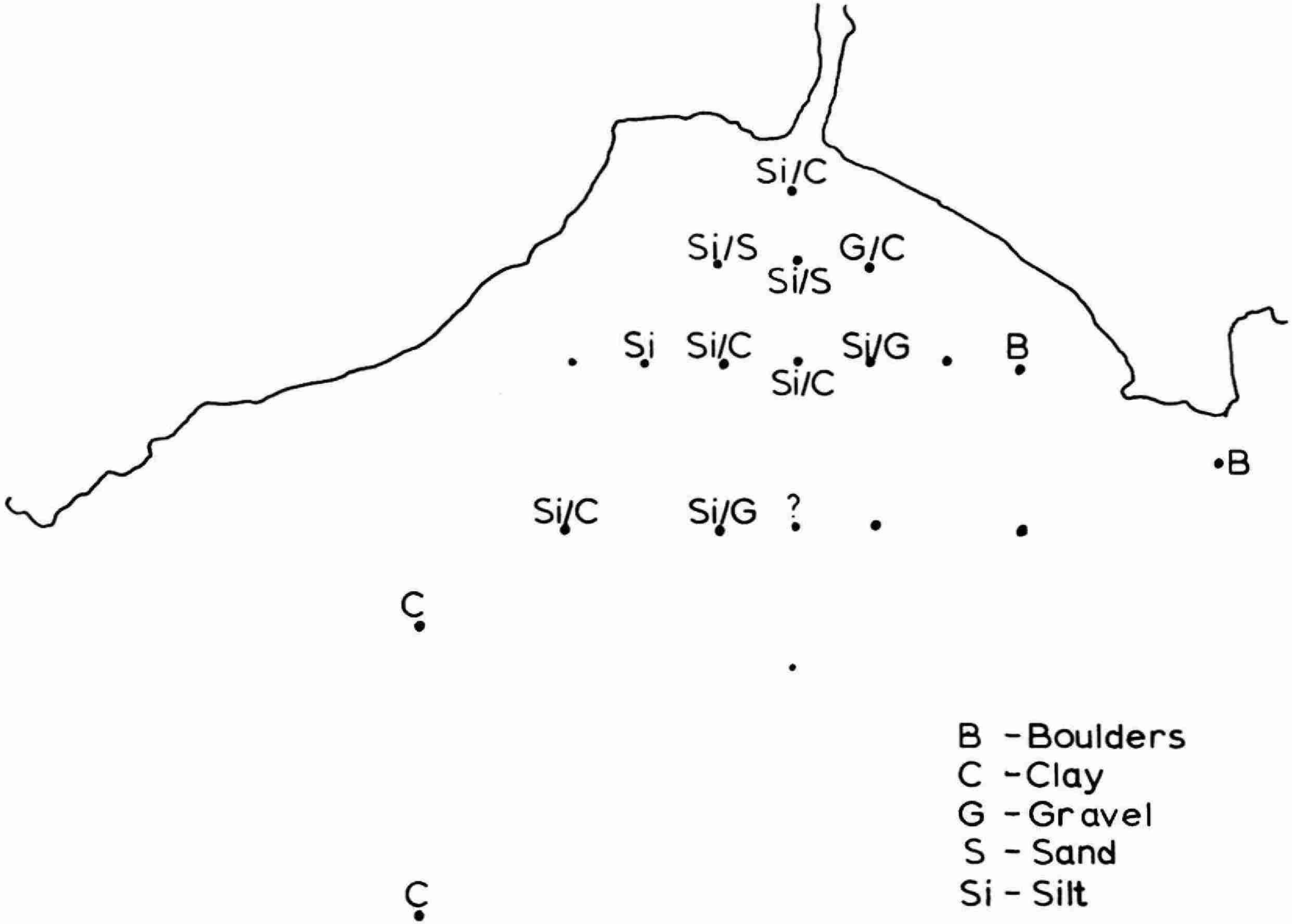

Figure 2. Distribution of sediments in the study area.

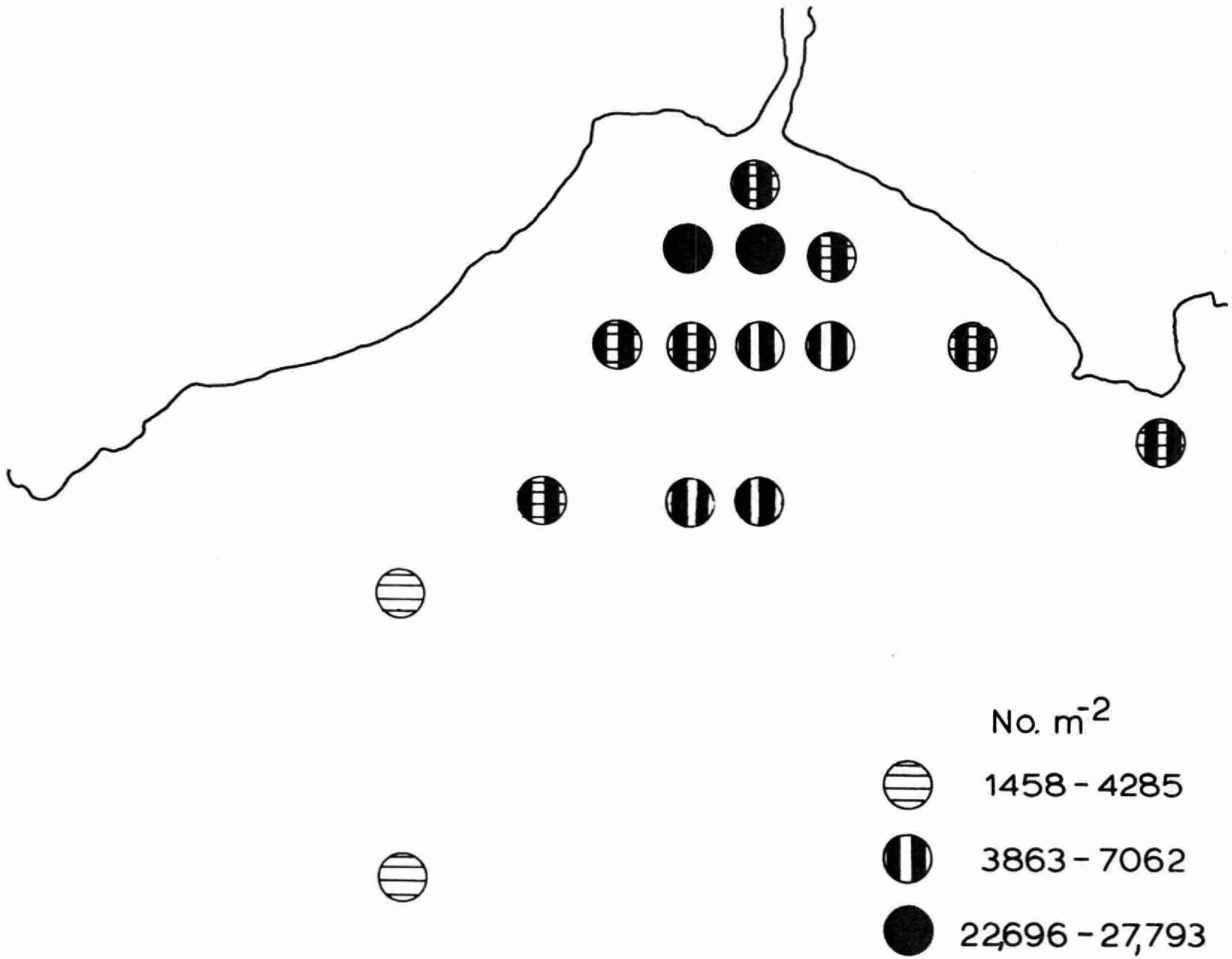

Figure 3. Distribution of total invertebrate abundance.

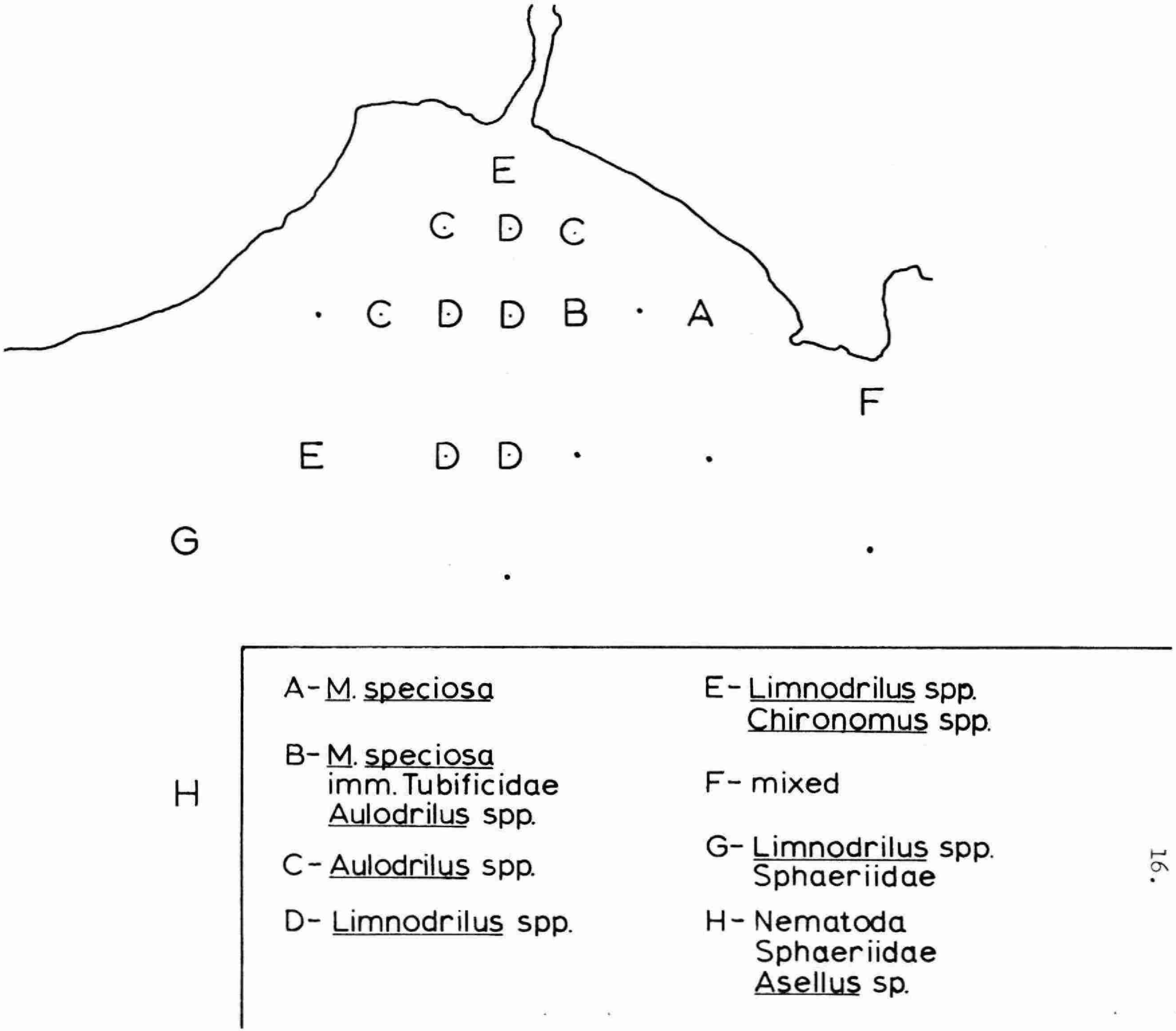

Figure 4. Invertebrate communities near the mouth of the Grand River.

A. List of taxa found in samples collected near the mouth of the Grand River.

Coelenterata
1. *Hydra* sp.

Platyhelminthes
2. *Dugesia tigrina*
3. *Hydrolimax grisea*

4. Nematoda

Polychaeta
5. *Manayunkia speciosa*

Hirudinea
6. *Helobdella elongata*
7. *H. stagnalis*

Oligochaeta
Naididae
8. *Dero digitata*
9. *Piguetiella michiganensis*
10. *Slavina appendiculata*
Lumbriculidae
11. *Lumbriculus variegatus*
Tubificidae
12. Immature w/ hair setae
13. Immature w/o hair setae
14. *Ilyodrilus templetoni*
15. *Limnodrilus cervix*
16. *L. claparedeanus*
17. *L. hoffmeiteri*
18. *L. udekemianus*
19. *Peloscolex curvisetosus*
20. *P. ferox*
21. *P. freyi*
22. *Potamothrix moldaviensis*
23. *P. vejdovskyi*
24. *Tubifex tubifex*
25. *Aulodrilus americanus*
26. *A. limnobius*
27. *A. piqueti*
28. *A. pluriseta*
29. *Branchiura sowerbyi*

Amphipoda
30. *Crongonyx gracilis*
31. *Gammarus fasciatus*

Isopoda
32. *Asellus r. racovitzai*

Decopoda
33. *Cambarus* sp.

34. Hydracarina

Gastropoda
35. *Amnicola integra*
36. *A. limosa*
37. *Bithinia tentaculata*
38. *Ferrissia* sp.
39. *Goniobasis livescens*
40. *Gyraulus parvus*
41. *Lymnaea auricularia*
42. *Marstonia decepta*
43. *Physa* sp.
44. *Valvata sincera*
45. *V. tricarinata*

Sphaeriidae
46. *Musculium partumieum*
47. *M. transversum*
48. *Pisidium ?casertanum*
49. *P. compressum*
50. *P. dubium*
51. *P. henslowanum*
52. *P. subtruncatum*
53. *P. ?supinum*
54. *P. variabile*
55. *P. venticosum*
56. *Sphaerium corneum*
57. *S. rhomboideum*
58. *S. simile*

Insecta
Ephemeroptera
59. *Caenis* sp.
60. *Stenacron interpunctatum*
Trichoptera
61. *Oecetis* sp.
62. *Polycentropus* sp.
Coleoptera
63. *Dubiraphia* sp.
64. *Stenelmis* sp.
Diptera
65. Ceratopogonidae
Chironomidae
66. *Ablabesmyia* sp.
67. *Tanypus stellatus*
68. *Procladius* sp.

Appendix. A. (cont'd)

69. Chironomus fluviatilis-gp.
70. C. plumosus-gp.
71. C. semireductus-gp.
72. Cryptochironomus sp.
73. Cryptotendipes sp.
74. Demicryptochironomus sp.
75. Microtendipes cf. pedellus
76. Paracladopelma sp.
77. Paratendipes sp.
78. Polypedilum scalaenum
79. Pseudochironomus sp.
80. Tanytarsus sp.
81. Heterotrissocladius changi

B. Detailed list of samples. Taxa numbers refer to list A.

Taxon	Station	15-016		1054			1064		
	Sample	A	Ponar	A	B	C	A	B	C
4		-	-	-	-	-	-	8	-
8		12	-	16	-	-	3	-	-
12		5	-	16	44	24	48	20	76
13		19	21	576	1704	800	95	52	227
14		1	-	-	-	-	-	-	-
15		13	3	-	152	24	14	17	46
16		-	-	-	-	-	-	2	-
17		7	-	16	20	24	22	16	4
18		-	-	-	-	-	-	4	-
19		-	-	-	-	-	-	-	2
22		-	1	-	-	24	28	2	21
23		-	-	16	-	-	-	-	-
24		-	-	-	-	-	3	-	8
25		-	-	-	20	-	6	-	17
27		-	-	16	-	-	-	-	-
28		-	-	-	20	-	-	-	-
29		-	-	-	-	-	1	4	3
30		-	-	-	-	-	-	-	1
31		1	5	4	16	8	-	-	-
32		-	-	-	4	-	-	-	-
34		1	-	-	4	-	-	-	-
40		-	-	-	4	-	-	-	-
42		-	-	-	-	-	-	-	1
43		2	-	-	-	8	-	-	-
53		-	2	-	-	-	-	2	-
55		-	-	8	4	8	-	-	-
63		-	-	-	4	-	-	-	-
65		1	-	-	-	-	-	-	1
67		-	-	-	-	-	4	1	5
68		7	2	-	8	-	1	1	2
69		32	3	-	-	-	4	3	4
70		37	1	12	28	56	1	-	15
72		7	2	-	-	-	-	-	-
73		1	-	-	-	-	-	-	-
74		-	1	-	-	8	-	-	-
77		-	1	-	-	-	-	-	-
78		1	-	-	4	-	-	-	-
80		-	-	4	4	-	-	-	-

B. (cont'd)

Station	1071		1133			1139		
Sample	A	B	A	B	C	A	B	C
Taxon								
3	-	-	3	14	12	-	-	-
4	-	-	2	-	-	1	1	2
5	-	1	2	14	8	-	-	-
7	-	1	-	-	-	2	2	1
10	-	-	-	2	-	-	-	-
11	-	-	-	-	-	-	-	1
12	6	15	-	-	-	-	-	-
13	96	245	94	72	45	12	32	30
15	54	133	-	-	2	2	12	8
16	-	5	-	-	-	-	-	-
17	9	36	8	2	6	15	14	13
18	-	5	-	-	-	1	-	2
20	-	-	-	-	-	1	-	1
24	-	-	2	-	-	-	-	-
25	-	10	2	-	6	1	-	1
26	-	-	15	17	4	-	-	-
27	-	-	17	26	4	-	-	-
28	15	5	-	2	-	2	-	-
29	10	19	-	-	-	-	-	-
30	-	-	1	-	8	-	-	-
31	-	-	1	-	-	5	-	2
32	-	-	3	3	5	1	-	-
33	-	-	-	-	1	-	-	-
34	-	-	-	1	-	-	-	-
35	-	-	-	-	-	-	-	1
36	-	-	1	-	-	1	1	-
37	-	-	7	-	-	-	-	-
38	-	-	-	1	-	-	-	-
39	-	-	-	1	-	-	-	-
42	-	-	8	4	-	-	-	-
43	-	-	2	1	1	1	-	-
44	-	-	-	-	-	2	-	4
45	-	-	1	-	-	4	1	6
47	-	-	-	-	-	-	1	2
48	-	3	8	6	9	-	-	-
49	-	7	-	1	-	-	1	-
52	-	-	-	-	-	1	5	4
54	-	-	-	-	-	12	3	1
55	-	2	-	-	-	-	-	-
56	-	-	1	1	-	1	-	3
58	-	-	-	-	-	5	1	-
60	-	-	-	-	2	-	-	-
62	-	-	-	-	2	-	-	-
64	-	-	-	-	-	-	1	-
66	-	-	-	-	1	-	-	-
67	-	-	-	1	1	-	-	-
68	3	-	4	-	2	2	1	4
69	-	-	-	-	-	4	12	1
70	-	-	1	2	2	-	2	-

B. (cont'd)

Station	1071		1133			1139		
Sample	A	B	A	B	C	A	B	C
Taxon								
73	-	-	-	-	-	10	-	10
76	-	-	-	-	-	1	-	1
80	-	-	5	2	1	-	-	-

	1236			1279			1280		
	A	B	C	A	B	C	A	B	C
3	-	-	-	-	1	-	-	-	-
4	3	74	7	-	-	-	-	-	-
6	-	-	-	-	3	-	-	-	-
7	2	3	1	1	1	-	-	-	-
8	-	-	-	-	-	-	-	3	2
10	-	-	-	-	-	-	-	3	-
11	-	2	5	-	-	-	-	-	-
13	-	-	-	49	122	47	3	29	8
15	-	-	-	34	69	13	-	5	1
17	-	-	-	36	30	18	-	2	-
20	-	4	1	3	-	-	1	3	-
23	-	-	2	-	-	-	3	16	7
25	-	-	-	-	3	7	12	16	5
26	-	-	-	-	-	-	1	5	1
27	-	-	-	-	-	-	2	21	7
28	-	1	-	-	13	2	3	62	18
31	2	-	-	-	-	-	1	--	-
32	10	38	-	-	-	-	-	-	-
36	-	-	-	1	-	1	-	-	-
37	-	1	-	-	-	-	-	-	-
44	5	1	-	-	-	-	-	-	-
45	-	-	-	1	-	-	-	-	-
46	-	-	-	-	1	-	-	-	-
49	2	1	-	-	-	-	-	-	-
51	-	-	-	-	-	4	-	-	-
54	16	7	-	1	-	-	-	-	-
55	1	-	-	2	1	1	-	1	-
56	15	15	1	-	-	-	-	-	-
58	-	-	-	-	6	-	-	-	-
67	-	-	-	-	-	-	-	-	1
68	2	8	1	2	9	5	2	3	-
69	3	7	1	10	21	25	-	-	-
70	-	-	-	3	-	1	-	2	1
73	-	-	-	1	-	-	1	-	-
75	-	-	-	1	-	-	-	-	-
80	-	1	1	-	-	-	-	-	-

B. (cont'd)

Station	1281			1282			1283		
Sample	A	B	C	A	B	C	A	B	C
Taxon									
3	14	23	20	-	-	-	-	-	-
4	-	-	8	-	-	-	-	-	-
7	-	-	-	-	-	-	-	1	-
8	-	-	-	4	-	-	-	-	-
12	6	-	35	11	3	3	-	8	-
13	323	235	1050	126	95	47	54	157	205
15	6	18	35	79	48	27	36	30	197
17	60	37	105	14	13	6	16	34	49
18	-	-	-	14	-	3	-	-	-
22	18	9	35	-	-	-	-	-	16
23	12	9	175	-	-	-	-	7	-
25	6	23	105	-	-	-	-	-	-
26	36	129	385	-	-	-	-	-	-
27	6	5	-	-	-	-	-	-	-
28	18	60	210	-	-	-	-	-	-
29	-	-	-	10	8	4	1	4	4
31	2	1	4	5	3	-	1	1	-
32	-	1	-	--	-	-	-	-	-
44	-	-	2	-	-	-	-	-	-
47	-	-	2	-	-	-	2	1	-
49	-	-	-	1	-	-	-	-	1
50	-	-	-	-	-	-	1	2	-
52	3	3	2	2	-	-	-	-	-
61	-	3	-	-	-	-	-	-	-
63	5	11	12	-	-	-	-	-	-
65	-	-	-	-	1	-	-	-	-
66	-	1	-	-	-	-	-	-	-
67	2	-	-	-	-	-	-	2	2
68	26	22	34	-	-	1	-	-	-
69	-	-	8	-	-	-	-	-	-
70	6	12	10	1	1	-	-	2	-
71	-	-	-	-	1	-	1	1	-
80	1	2	12	-	-	-	-	-	-

	1284			1285 Ponar			1285 airlift		
	A	B	C	A	B	C	A	B	C
1	-	-	-	-	-	-	-	2	-
2	-	-	-	-	-	18	-	2	-
3	-	1	1	4	2	3	2	5	1
4	-	3	4	-	-	-	1	-	-
5	-	14	-	-	-	-	5	140	39
7	-	-	-	-	-	-	-	1	-
8	1	19	6	-	-	-	-	-	-
9	1	15	5	-	-	-	-	-	-
12	-	4	-	3	1	-	3	-	-
13	17	53	25	29	8	-	156	122	84
15	1	-	-	-	-	-	3	-	6

B. (cont'd)

Station	1284			1285 Ponar			1285 airlift		
Sample	A	B	C	A	B	C	A	B	C
Taxon									
17	-	-	-	-	-	-	27	4	6
21	1	4	1	-	-	-	-	-	-
22	1	8	3	4	7	-	-	-	-
23	1	4	-	9	3	-	-	4	-
25	-	4	-	-	4	-	-	7	9
26	35	57	25	-	-	-	-	11	26
27	13	68	25	-	-	-	-	14	6
28	13	34	18	4	1	-	-	7	14
29	-	-	2	-	-	-	-	-	-
31	-	-	-	-	-	-	-	1	-
32	-	-	-	-	-	1	-	-	-
36	-	-	1	-	-	-	1	16	2
37	-	-	-	-	-	-	-	1	-
40	-	-	-	-	-	1	-	4	-
41	-	1	-	-	-	-	-	-	-
42	-	-	-	1	-	-	-	1	1
43	-	-	-	-	-	-	-	1	-
45	-	-	-	-	-	-	-	2	1
49	-	1	-	-	1	-	1	-	3
50	-	-	-	-	-	-	2	17	2
52	-	-	-	-	1	-	-	-	-
55	-	-	-	-	-	-	-	4	-
57	-	-	-	-	1	-	-	-	-
61	-	-	-	-	-	-	-	1	-
63	-	-	-	-	-	-	-	1	-
67	-	-	-	-	-	-	-	1	1
68	1	3	1	4	4	-	14	5	14
69	-	-	-	-	-	-	7	5	4
70	-	-	-	2	-	-	-	-	-
72	-	-	4	-	-	-	-	-	-
73	-	1	-	2	-	-	-	-	-
75	-	-	-	-	-	1	-	1	-
78	-	2	1	-	1	-	-	1	-
79	-	-	-	-	-	-	-	1	-
80	2	21	12	4	2	-	25	11	14

	1288		
	A	B	C
1	-	1	-
2	4	4	4
3	5	1	3
4	5	3	6
5	72	68	144
9	-	-	2
12	1	2	2
13	5	8	7
23	2	3	1
26	3	16	12

B. (cont'd)

Station	1288		
Sample	A	B	C
Taxon			
27	-	3	-
28	1	8	2
31	1	-	1
34	-	-	2
36	-	1	3
43	-	1	1
44	4	-	8
45	1	-	2
49	-	1	-
52	-	-	1
59	-	-	1
61	4	-	-
68	10	5	2
72	1	-	1
73	1	-	-
75	6	5	4
78	1	2	1
79	-	1	-
80	16	14	13
81	-	-	2

(9165)
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Barton, David R.
A survey of benthic
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